

What is claimed is:

- 1 1. An optical transmitting apparatus for a
2 ring transmission system used in a ring transmission
3 system in which a plurality of optical transmitting
4 apparatuses are connected to one another over a
5 bidirectional ring transmission path having a data
6 link channel in which crossconnect information
7 representing an add node identifier representing a
8 node adding an optical signal and a drop node
9 identifier representing a node dropping an optical
10 signal is written, said optical transmitting
11 apparatus comprising:
12 a data link reading means for reading said
13 crossconnect information and topology information
14 uniquely representing the order of arrangement of
15 optical transmitting apparatuses connected in ring;
16 a topology creating means for creating a
17 topology using said topology information read by said
18 data link reading means;
19 a data link writing means for writing a unique
20 absolute node identifier given to each of said plural
21 optical transmitting apparatuses and a relative node
22 identifier given by relating absolute node
23 identifiers of other nodes with said topology in said
24 crossconnect information of said data link channel on
25 the basis of said topology created by said topology

004207-ET956960

26 creating means; and
27 a squelch table creating means for creating
28 a squelch table holding said crossconnect information
29 written in said data link channel.

1 2. An optical transmitting apparatus for a
2 ring transmission system used in a ring transmission
3 system in which a first ring transmission system in
4 which a plurality of optical transmitting apparatuses
5 are connected to one another over a bidirectional ring
6 transmission path having a data link channel in which
7 crossconnect information representing an add node
8 identifier representing a node adding an optical
9 signal and a drop node identifier representing a node
10 dropping the optical signal is written is coupled with
11 a second ring transmission system in which a plurality
12 of optical transmitting apparatuses are connected to
13 one another over a bidirectional ring transmission path
14 having said data link channel; said optical
15 transmitting apparatus comprising:

16 a data link reading means for reading said
17 crossconnect information of said data link channel and
18 topology information uniquely representing the order
19 of arrangement of optical transmitting apparatuses
20 connected in ring;

21 a topology creating means for creating a
22 topology using said topology information read by said

004207" ET950960

23 data link reading means;

24 a data link writing means for writing a unique
25 absolute identifier given to each of a plurality of
26 optical transmitting apparatuses and a relative node
27 identifier given by relating absolute node
28 identifiers of other nodes with said topology in said
29 crossconnect information of said data link channel on
30 the basis of said topology created by said topology
31 creating means;

32 a squelch table creating means for creating
33 a squelch table holding said crossconnect information
34 written in said data link channel;

35 an RIP table creating means for creating an
36 RIP table holding a primary node identifier indicating
37 a primary node which transmits said optical signal
38 from said first ring transmission path to said second
39 ring transmission path, a secondary node identifier
40 indicating a secondary node adjacent to said primary
41 node to transmit/receive said optical signal, and said
42 drop node identifier for each of a working line and
43 a protection line on the basis of said crossconnect
44 information; and

45 a node recognizing means being able to
46 recognize from said relative node identifier of said
47 crossconnect information read by said data link
48 reading means which its own node is said primary node
49 or said secondary node.

00420T"ET955960

1 3. The optical transmitting apparatus for a
2 ring transmission system according to claim 1, wherein
3 said data link writing means sets an absolute node
4 identifier of its own node to said add node identifier
5 of said data link channel when its own node is said
6 add node, and sets said drop node identifier of said
7 data link channel to a relative node identifier of its
8 own node corresponding to said add node identifier
9 when its own node is said drop node.

1 4. The optical transmitting apparatus for a
2 ring transmission system according to claim 2, wherein
3 said data link writing means sets an absolute node
4 identifier of its own node to said add node identifier
5 of said data link channel when its own node is said
6 add node, and sets said drop node identifier of said
7 data link channel to a relative node identifier of its
8 own node corresponding to said add node identifier
9 when its own node is said drop node.

1 5. The optical transmitting apparatus for a
2 ring transmission system according to claim 1, wherein
3 data other than zero is used as said relative node
4 identifier set by said data link writing means, and
5 said node recognizing means recognizes presence or
6 absence of zero data in a region in which said drop

004207" ET956960

1 6. The optical transmitting apparatus for a
2 ring transmission system according to claim 2, wherein
3 data other than zero is used as said relative node
4 identifier set by said data link writing means, and
5 said node recognizing means recognizes presence or
6 absence of zero data in a region in which said drop
7 node identifier of said data link channel is written
8 to determine whether or not setting of said
9 crossconnect information is completed.

1 7. The optical transmitting apparatus for a
2 ring transmission system according to claim 2, wherein
3 said node recognizing means comprises:
4 an additional information determining means
5 being able to determine which a connection mode of said
6 first ring transmission system or said second ring
7 transmission system is in a DCP connection in which
8 said optical signal is dropped from said primary node
9 while continued over said protection line or in a DTP
10 connection in which said optical signal is continued
11 over both of said working line and said protection line
12 on the basis of information written in said squelch
13 table.

1 8. The optical transmitting apparatus for a
2 ring transmission system according to claim 7, wherein
3 said additional information determining means
4 determines which said first ring transmission system
5 or said second ring transmission system is in said DCP
6 connection or in said DTP connection from which a
7 direction of its own node identifier indicating its
8 own node looked from said primary node identifier is
9 in the same direction as or in the opposite direction
10 to the order of arrangement of nodes represented by
11 said topology.

1 9. The optical transmitting apparatus for a
2 ring transmission system according to claim 1, wherein
3 said squelch table creating means is such configured
4 as to create the same squelch table among optical
5 transmitting apparatuses of said ring transmission
6 system.

1 10. The optical transmitting apparatus for a
2 ring transmission system according to claim 2, wherein
3 said squelch table creating means is such configured
4 as to create the same squelch table among optical
5 transmitting apparatuses of said ring transmission
6 system.

004201" ET 956960

1 11. The optical transmitting apparatus for a
2 ring transmission system according to claim 2, wherein
3 said RIP table creating means is such configured as
4 to create the same RIP table among optical
5 transmitting apparatuses of said ring transmission
6 system.

1 12. An optical transmitting method for a ring
2 transmission system used in a ring transmission system
3 in which a plurality of nodes are connected to one
4 another over a bidirectional ring transmission path
5 having a data link channel in which crossconnect
6 information representing an add node identifier
7 representing a node adding an optical signal and a drop
8 node identifier representing a node dropping an
9 optical signal is written, said optical transmitting
10 method performed in each of said node comprising the
11 steps of:

12 a data link reading step of reading said
13 crossconnect information and topology information
14 uniquely representing the order of arrangement of
15 optical transmitting apparatuses connected in ring;

16 a topology creating step of creating a
17 topology using said topology information read at said
18 data link reading step;

19 a data link writing step of writing a unique
20 absolute node identifier given to each of a plurality

004201" 27956960

21 of nodes and a relative node identifier given by
22 relating absolute node identifiers of other nodes with
23 said topology in said crossconnect information of said
24 data link channel on the basis of said topology created
25 at said topology creating step; and

26 a squelch table creating step of creating a
27 squelch table holding said crossconnect information
28 written in said data link channel.

1 13. An optical transmitting method for a ring
2 transmission system used in a first ring transmission
3 system in which a plurality of nodes are connected to
4 one another over a bidirectional ring transmission
5 path having a data link channel in which crossconnect
6 information representing an add node identifier
7 indicating a node adding an optical signal and a drop
8 node identifier indicating a node dropping the optical
9 signal is written, and a second ring transmission
10 system in which a plurality of nodes are connected to
11 one another over a bidirectional ring transmission
12 path having said data channel,

13 wherein said first ring transmission system
14 comprises:

15 a first add/drop node for receiving
16 an optical signal transmitted from an external node
17 over a working line and transmitting said optical
18 signal to another node of said first ring transmission

09695613-102400

19 system over said working line, while receiving an
20 optical signal transmitted from another node of said
21 first ring transmission system over said working line;

22 a first primary node for receiving
23 said optical signal transmitted from said first
24 add/drop node over said working line and transmitting
25 said optical signal to an external ring transmission
26 system and another node of said first ring
27 transmission system over said working line, while
28 receiving an optical signal transmitted from said
29 external ring transmission system over said working
30 line and an optical signal transmitted from another
31 node of said first ring transmission system over a
32 protection line, selecting either one of said received
33 optical signals, and transmitting said selected
34 optical signal to another node of said first ring
35 transmission system over said working line;

36 a first secondary node for receiving
37 said optical signal transmitted from said first
38 primary node over said protection line and
39 transmitting said optical signal to said external ring
40 transmission system over said protection line, while
41 receiving said optical signal transmitted from said
42 external ring transmission system over said
43 protection line and transmitting said optical signal
44 to said first primary node over said protection line;

45 said second ring transmission system

004201 ET956960
09695613 102400

46 comprises:

47 a second secondary node for receiving
48 said optical signal transmitted from said first
49 secondary node of said first ring transmission system
50 over said protection line and transmitting said
51 optical signal to said second ring transmission system
52 over said protection line;

53 a second primary node for receiving
54 an optical signal transmitted from said first primary
55 node of said first ring transmission system over said
56 working line and said optical signal transmitted from
57 said second secondary node over said protection line
58 and transmitting said optical signal to another node
59 of said second ring transmission system over said
60 working line, while receiving an optical signal
61 transmitted from another node of said second ring
62 transmission system over said working line,
63 transmitting said optical signal to said first primary
64 node of said first ring transmission system, and
65 transmitting said optical signal to said second
66 secondary node;

67 a second add/drop node for receiving
68 an optical signal transmitted from an external ring
69 transmission system over said working line and
70 transmitting said optical signal to another node of
71 said second ring transmission system over said working
72 line, while receiving said optical signal transmitted

09695613-102400

73 from another node of said second ring transmission
74 system over said working line and transmitting said
75 optical signal to said external ring transmission
76 system over said working line;

77 said optical transmitting method performed in
78 each of said nodes comprising the steps of:

79 a data link reading step of reading said
80 crossconnect information of said data link channel and
81 topology information uniquely representing the order
82 of arrangement of optical transmitting apparatuses
83 connected in ring;

84 a topology creating step of creating a
85 topology using said topology information read at said
86 data link reading step;

87 a data link writing step of writing a unique
88 absolute node identifier given to each of a plurality
89 of nodes and a relative node identifier given by
90 relating absolute node identifiers of other nodes with
91 said topology in said crossconnect information of said
92 data link channel on the basis of said topology created
93 at said topology creating step;

94 a squelch table creating step of creating a
95 squelch table holding said crossconnect information
96 written in said data link channel;

97 an RIP table creating step of creating an RIP
98 table holding a primary node identifier indicating a
99 primary node transmitting said optical signal from

00420T-ET956960

100 said first ring transmission path to said second ring
101 transmission path, a secondary node identifier
102 indicating a secondary node adjacent to said primary
103 node to transmit/receive said optical signal, and said
104 drop node identifier for each of said working line and
105 said protection line on the basis of said crossconnect
106 information; and

107 a node recognizing step of recognizing from
108 said relative node identifier of said crossconnect
109 information read at said data link reading step which
110 its own node is said primary node or said secondary
111 node.

1 14. An optical transmitting method for a ring
2 transmission system used in a first ring transmission
3 system in which a plurality of nodes are connected to
4 one another over a bidirectional ring transmission
5 path having a data link channel in which crossconnect
6 information representing an add node identifier
7 indicating a node adding an optical signal and a drop
8 node identifier indicating a node dropping an optical
9 signal is written and a second ring transmission
10 system in which a plurality of nodes are connected to
11 one another over a bidirectional ring transmission
12 path having said data link channel,

13 wherein said first ring transmission system
14 comprises:

004201-102400

15 a first add/stop node for receiving
16 an optical signal transmitted from an external node
17 over a working line, transmitting said optical signal
18 to said first ring transmission system over said
19 working line, and transmitting said optical signal to
20 said first ring transmission system over a protection
21 line, while receiving an optical signal transmitted
22 from another node of said first ring transmission
23 system over said working line, receiving an optical
24 signal transmitted from another node of said first
25 ring transmission system over said protection line,
26 and transmitting said optical signal to an external
27 ring transmission system over said working line;

28 a first primary node for receiving
29 said optical signal transmitted from said first
30 add/drop node over said working line, and transmitting
31 said optical signal to an external ring transmission
32 system and another node of said first ring
33 transmission system over said working line, while
34 receiving an optical signal transmitted from said
35 external ring transmission system over said working
36 line and an optical signal transmitted from another
37 node of said first ring transmission system over said
38 protection line, selecting either one of said received
39 optical signals, and transmitting said selected
40 optical signal to another node of said first ring
41 transmission system over said working line;

004207" ET95950

42 a first secondary node for receiving
43 an optical signal transmitted from said first add/drop
44 node over said protection line, and transmitting said
45 optical signal to a node of said external ring
46 transmission system over said protection line, while
47 receiving an optical signal transmitted from a node
48 of said external ring transmission system over said
49 protection line, and transmitting said optical signal
50 to said first add/drop node over said protection line;

53 a second primary node for receiving
54 said optical signal transmitted from said first
55 primary node of said first ring transmission system
56 over said working line, and transmitting said optical
57 signal to another node of said second ring
58 transmission system over said working line, while
59 receiving an optical signal transmitted from another
60 node of said second ring transmission system over said
61 working line, and transmitting said optical signal to
62 said first primary node of said first ring
63 transmission system over said working line;

69 transmission ring over said protection line, while
70 receiving said optical signal transmitted from
71 another node of said second ring transmission system
72 over said protection line, and transmitting said
73 optical signal to said first secondary node of said
74 first ring transmission system over said protection
75 line;

76 a second add/drop node for receiving
77 said optical signal transmitted from said second
78 primary node over said protection line, receiving said
79 optical signal transmitted from another node of said
80 second ring transmission system over said working line,
81 and transmitting said optical signal to an external
82 ring transmission system over said working line, while
83 receiving an optical signal transmitted from said
84 external ring transmission system over said working
85 line, transmitting said optical signal to another node
86 of said second ring transmission system over said
87 working line, and transmitting said optical signal to
88 another node of said second ring transmission system
89 over said protection line;

90 said optical transmitting method performed in
91 each of said nodes comprising the steps of:

92 a data link reading step of reading said
93 crossconnect information of said data link channel and
94 topology information uniquely representing the order
95 of arrangement of optical transmitting apparatuses

004207 ET955960

96 connected in ring;

97 a topology creating step of creating a

98 topology using said topology information read at said

99 data link reading step;

100 a data link writing step of writing a unique

101 absolute node identifier given to each of a plurality

102 of nodes and a relative node identifier given by

103 relating absolute node identifiers of other nodes with

104 said topology in said crossconnect information of said

105 data link channel on the basis of said topology created

106 at said topology creating step;

107 a squelch table creating step of creating a

108 squelch table holding said crossconnect information

109 written in said data link channel;

110 an RIP table creating step of creating an RIP

111 table holding a primary node identifier indicating a

112 primary node transmitting said optical signal from

113 said first ring transmission path to said second ring

114 transmission path, a secondary node identifier

115 indicating a secondary node adjacent to said primary

116 node to transmit/receive said optical signal, and said

117 drop node identifier for each of said working line and

118 said protection line on the basis of said crossconnect

119 information; and

120 a node recognizing step of recognizing from

121 said relative node identifier of said crossconnect

122 information read at said data link reading step which

004207-CT956960

123 its own node is said primary node or said secondary
124 node.

1 15. The optical transmitting method for a ring
2 transmission system according to claim 12, wherein at
3 said data link writing step, data other than zero is
4 used as said relative node identifier.

1 16. The optical transmitting method for a ring
2 transmission system according to claim 13, wherein at
3 said node recognizing step, presence or absence of
4 zero data in a region in which said drop node
5 identifier of said data link is written is recognized
6 to determine whether or not setting of said
7 crossconnect information is completed.

1 17. An optical transmitting apparatus for a
2 ring transmission system used in a transmission ring
3 in which a plurality of optical transmitting
4 apparatuses are connected to one another over a
5 bidirectional ring transmission path comprising:
6 a connection mode recognizing means,
7 connected to said bidirectional ring transmission
8 path, for recognizing a connection mode between said
9 transmission ring and another transmission ring
10 connected to said transmission ring;
11 a failed span detecting means, connected to

004207" ET955950

12 said connection mode recognizing means, for detecting
13 a span in which a failure occurs; and
14 a loop-back switching control means,
15 connected to said connection mode recognizing means
16 and said failed span detecting means, for switching
17 a transmission route on the basis of said connection
18 mode and said span.

1 18. The optical transmitting apparatus for a
2 ring transmission system according to claim 17,
3 wherein said connection mode recognizing means
4 centrally recognizes information on a terminal
5 optical transmitting apparatus connected to said
6 bidirectional ring transmission path to add/drop said
7 optical signal, connection mode information on said
8 connection mode of said terminal optical transmitting
9 apparatus, and line type information representing a
10 working/protection line type.

1 19. The optical transmitting apparatus for a
2 ring transmission system according to claim 18,
3 wherein said connection mode recognizing means
4 recognizes a DTP connection in which at least two of
5 said terminal optical transmitting apparatuses
6 connected to said transmission ring continue to
7 transmit said optical signal using both of said
8 working line and said protection line.

004207"ET955960

1 20. The optical transmitting apparatus for a
2 ring transmission system according to claim 17 further
3 comprising:

4 a path switching means, connected to said
5 loop-back switching control means, for selecting
6 either one having a better quality of a first optical
7 signal from one direction and a second optical signal
8 from another direction on said bidirectional ring
9 transmission path.

1 21. An optical transmitting method for a ring
2 transmission system used in a transmission ring in
3 which a plurality of optical transmitting apparatuses
4 are connected to one another over a bidirectional ring
5 transmission path, said optical transmitting method
6 comprising the steps of:

7 a connection mode recognizing step of
8 recognizing a connection mode between said
9 transmission ring and another transmission ring
10 connected to said transmission ring;

11 a failed span detecting step of detecting a
12 span in which a failure occurs on the basis of said
13 connection mode recognized at said connection mode
14 recognizing step; and

15 a loop-back switching controlling step of
16 switching a transmission route on the basis of said

00695613-102400

17 connection mode recognized at said connection mode
18 recognizing step and said span detected at said failed
19 span detecting step in order to minimize a loop-back
20 distance of an optical signal in said transmission
21 ring.

091695613 102400